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(54) **A method of transporting, installing or removing a marine object, and a semi-submersible vessel for implementation of the method.**

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(73) Proprietor: DOCK-EXPRESS SHIPPING B.V.
Achterdijk 51
NL-3161 EB Rhoon(NL)

(72) Inventor: Leenaars, Cees E. J.
Veerkade 5
Harbor No. 183
NL-3016 DE Rotterdam(NL)

(74) Representative: Kooy, Leendert Willem et al
OCTROOIBUREAU VRIESENDORP & GAADE
P.O. Box 266
NL-2501 AW The Hague (NL)

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Description

The invention relates to a method of transporting, installing and removing a marine object such as a topside of a jacket platform by means of a buoyant body. Furthermore, this invention relates to a vessel for implementation of the method.

A method and a vessel of the type described in the pre-characterizing portions of claims 1 and 5, resp., are known from UK patent application 2 186 527. According to this method, a vessel consisting of a stern section and a bow section and being provided with supporting skid beams on deck of the stern section is used for removing a topside from a jacket structure. The ballasted stern and bow section are accurately positioned on either side of the jacket structure, and the skid beams are then slid from the stern section, underneath the topside, to a position in which their outer ends find support on deck of the bow section and may be locked into position. Subsequently, the vessel is de-ballasted again, so as to bring the skid beams bridging the distance between stern and bow section into supporting contact with the topside. Next, the vessel is moved sideways, away from the jacket structure, the stern and bow section are rejoined, and the vessel with the topside on deck sets sail.

According to another known method disclosed in NL patent application 87 00076, use is made of a catamaran-like vessel, consisting of two VLLCCs connected to each other by means of a transverse structure located above the waterline. The tranverse structure terminates at a distance from the bows of the tankers, so as to realize a bay in the bow portion of the vessel. Support beams for e.g. a topside are arranged transversely to the bow area, supporting at their ends on columns placed on large floatation structures located in fluid chambers in the hulls of the VLCCs. When a topside is to be placed on a jacket structure, first the vessel is ballasted to reduce the level of the topside while the fluid chambers are filled with water and the vessel is positioned with both bows on either side of the jacket structure. Then the floating constructions are filled with water in a controlled manner, in order to lower the column, and consequently the same happens to the support beam and the topside in relation to the vessel and the jacket structure until the latter takes the full weight of the topside.

The invention provides a method as described in claim 1.

Preferably, said object is supported by said outriggers during transport.

According to a preferred embodiment of the method of the invention, said transverse structure is lowered below water level when said buoyant body is ballasted during said transporting, installing or removing operations. As a result, the cross-sectional area at the waterline will be decreased substantially, thus reducing the possible influence of vertical water motion on the buoyant body.

At the loading or unloading destination the buoyant body is then ballasted and semi-submerged to such an extent that, under a heavy load, the transverse structure or deck would almost entirely disappear underwater. Only the longitudinal side structures, a bridge house and a part of the outriggers will still extend above water. Due to the outriggers which are embodied as tail ends extending over the rear of the vessel an increasing rate carrying capacity rearwards of the stern is obtained during submerging.

In order to compensate for the load on the outriggers, the outriggers can be provided with additional buoyant bodies which can be supplemented at the site.

These additional buoyant bodies which compensate for the load may be open from below so that they are to be trimmed with air pressure.

The invention further provides a vessel as described in claim 5.

Preferably, said outriggers have support surfaces which are arranged flush with the upper surfaces of the remaining parts of said longitudinal side structures.

The outriggers can be used for installation purposes in two manners:

A. in combination with one or more gantry cranes;

B. the direct use of outriggers to lift objects according to the fork-lift principle.

A. The Combination of Outriggers and Gantry Cranes

The combination of outriggers and gantry cranes can be used in principle for the installation of (sub)marine systems or objects at sea.

For submarine objects rather low gantry cranes would suffice, yet for installation of objects above water level higher gantry cranes are required.

The gantry cranes are preferably provided with a hydraulic lifting device which will be described later on.

The gantry cranes can, however, also be provided with a slide-or-roll system, so that they can transfer an object from inboard to outboard or vice versa.

The lifting device on the gantry cranes can be a hydraulic device with clamps a plurality of wires. The use of such a system for lifting loads offshore is an important aspect of the present invention.

The hydraulic lifting device is provided with two clamping systems which are attached to a hollow cylinder.

Both the movable part (the piston) and the fixed part are provided with a clamping system. By alternately using the two clamping devices the wires can be hauled through the jack or they can be paid out.

Especially the use at sea of this type of wire jack is an important aspect. Moreover, in one embodiment, this jack can also be mounted on a second hydraulic cylinder, wherein the roll and pitch motions of the ship are isolated from the load.

With the pilot line the compensation motion can be controlled.

Moreover, the unit can be connected to an air system for compensation of the vertical motions of the installation vessel.

B) The fork lift principle or directly lifting with the outriggers

Loads can offshore also directly be lifted by means of the outriggers.

As an example the top structure of a drilling platform is here described. Herewith the heavy load to be transported, particularly said top structure of a drilling platfrom, is lifted off the lower structure of the drilling platform according to the fork lift principle and loaded on the outriggers of a vessel, particularly the tail ends which are situated in the extension of the twin boards of a dockship, for the transport, and lifted off the outriggers to be installed on said lower structure, respectively.

Therewith the problem arises that the load each time should be positioned correctly with respect to the outriggers, and notably the top structure of a drilling platform, to be transported or to be installed, should be very accurately relatively adjusted between the outriggers of the vessel and the lower structure of the drilling platform.

This problem is solved effectively with the method according to the present invention by accurately positioning the outriggers under the load while utilizing carrier supports, and the preferred embodiment of an arrangement for performing this method is characterized by carrier supports upholding the load on each side, and furthermore by a support beam structure to be arranged on the outriggers under the load, with a position which is adjustable by means of carrier pads, with the carrier pad pressure being fluid-controlled. When the carrier pad pressure is sufficient the load will rest in a somewhat floating manner on the carrier pads so that a relative adjustment with respect to the outriggers which carry the load can be effected and, when the correct adjustment is reached, by reducing the carrier pad pressure a fixation of the adjustment can be obtained.

When lifting or lowering the top structure of a drilling platform on its lower structure, by slidingly shifting the supporting beams a finer adjustment of the top structure with respect to the lower structure is now obtained.

Moreover, the cyclic motions as a result of the swell are compensated.

Therewith is taken care that the relative shifting of the load with respect to the outriggers is steered in the right manner due to the fact that the carrier pads are adjustable in longitudinal alignments on the outriggers, said longitudinal alignments extending onto the gangways of the ship so that the carrier pads with the load carried thereby are displaceable between positions outboard and inboard, and furthermore also by alignments located under the transverse beams of the support beam structure, for self-adjustment of the carrier pads transversely. In this manner a universal adjustability of the load with respect to the outriggers is obtained.

This shifting of the supporting beams with respect to the outriggers can be effected:

- in that the supporting beams are actively controlled by hydraulic cylinders which control the supporting beams at the rate of the measured motions of the outriggers;
- by cross-wires which are passed from winches aboard the ship to the lower structure of the drilling platform and are secured thereon and/or
- by a homing system between the respective drilling platform legs as will be further described in the following.

Also a combination of the above mentioned systems is possible.

The choice which system is applicable will depend on the maximum allowable loads on the lower structure and the sea condition to be expected during the installation or removel.

The invention will be further described in the following in view of illustrative embodiments thereof as represented in the attendant drawings, which should, however, not be interpreted in a restrictive sense as of course other embodiments are feasible within its scope.

Figures 1, 2 and 3 represent embodiments of a barge with superstructures for installing or dismounting objects at sea under or above water.

Figure 2 shows possibilities for the connection of the three superstructures with working deck and accommodation above water.

Figure 3 shows an example with continuous dock walls.

Figure 4 depicts the use of outriggers and gantry cranes in a semi-submersible vessel.

Figure 5 gives possibilities of adding additional buoyancy to reduce the moments on the outriggers and is a schematic general perspective view of a semi-submersible vessel, such as a dockship, which as illustrated is engaged in loading the top

structure of a drilling rig or is lifting off this top structure from its outriggers to install it on the lower structure, the so-called jacket, of the drilling rig.

Figure 6 gives an example of a low gantry crane for operations under water.

Figure 7 gives an example of a high gantry crane for the operation above water.

Figure 8 shows the high gantry cranes which place an object underwater.

Figure 9 depicts a wire-jack which is to be used on a gantry crane in operations offshore.

Figure 10 shows the wire-jack mounted on a hydraulic cylinder for roll, pitch and vertical compensation.

Figure 11 is a schematic representation of a carrier pad system which is arranged on the outriggers under the load to make its correct positioning possible.

Figure 12 illustrates the compensation of notably the outrigger motions due to the swell, by means of a hydraulic jack.

Figure 13A and 13B show in longitudinal view and in rear view resilient cross-wires by which the water motion can be compensated.

Figure 14 shows the homing of top structure legs on the jacket structure.

Figure 15A shows supported on the boards of a dockship the top structure of a drilling platform, which is made ready for the transport, in end view as seen from the stern, and figure 15B is a corresponding lateral view of the ship aft.

The semi-submersible vessel 1 as represented in the drawings is shown in longitudinal and in plan view in figure 1 and is provided with with additional buoyant bodies 2 in the form of a watertight bridge house fore and, embodied as tail ends, outriggers in substantially the extension of the board walls 3 of the loading deck of the vessel 1, which is situated rearwardly of the bridge house.

As an example it is stated that the vessel 1 has a length of 180 m, a beam of 40 m and a depth of about 9 m, that the bridge house has a length of 20 m and the outriggers a length of 70 m, and that said buoyant bodies 2 extend to a heigth of 20 m above the base line of the vessel.

In figure 2 the transport draft t and the installation draft t' at sea of the vessel 1 are indicated. The load 4 depends here, as shown, from a working platform.

In figure 3a semi-submersible vessel or so-called "semi-submersible" 1 is represented, which is provided with fixed carrier legs 26 in the form of hollow columns, which hollow columns 26 extend through the water surface 29 and are connected at the bottom side, on each side of the vessel 1, by caisson floats 30, and between which the necessary supports in the form of braces and rungs such as 31 are arranged. On said carrier legs 26 rests a superstructure of which in figure 3 only the working deck 32 is schematically represented. Also this semi-submersible vessel 1 is provided with outriggers 2 by which a heavy load which here in this figure is not further represented, is to be controlled.

In figures 4 and 5 a semi-submersible vessel 1 consisting of a dockship is represented, which has outriggers 2 in the form af tail ends projecting in the extension of the twin boards 3, by which according to the fork lift principle a heavy load 4 which may consist of the top structure of a drilling rig, can be lifted off the jacket, indicated at 5, of the drilling rig, or from which the load 4 can be lifted to be installed on the jacket 5.

It is noted that the dockship 1 as represented in figures 4 and 5 has a large unobstructed hold 6 defined between said twin boards 3, which is to be closed by means of hatch covers, not represented in these figures, and which, for loading and unloading dry cargo through the hatch opening, is to be served by a gantry crane, generally indicated at 7, which rides on the gangways 8 on the twin boards 3, whereas in this ship 1 wet cargo may be stowed in the hold 6 through the stern 9 which is to be opened to that effect, and to that end the ship 1 will then be semi-submerged.

The heavy load, illustrated in figure 5, which as represented may consist of said top structure 4 of a drilling platform, is stowed on the outriggers 2 on a support beam structure to be placed under the load 4, comprising a plurality of supporting beams 10, with the interpositioning of fluid pads 11 which are indicated with dotted lines in figure 5 and are shown in more detail in figure 11. With a sufficient fluid pressure in the carrier pads 11 the load 4 will then arrive at a supporting condition which may be regarded as somewhat "floating" in order to, by slidingly shifting on the carrier pads 2 on the outriggers 2, thus be accurately located in a desired position, and upon locating it in the desired position, the fluid pressure may then be lowered and a fixed position be obtained.

This concerns lifting and removing the load 4 for its transport. When installing the topside 4 the operation is reversed, with some further provisions being made to position it on the jacket 5 as will be further described here in the following.

Positioning the vessel 1 with respect to the load 4 is in all cases in first instance being effected by trimming the vessel 1 with ballast.

For a universal displaceability of the load 4 with respect to the vessel 1 said carrier pads 11 are adapted to be slidingly shifted in longitudinal alignments 12 on the outriggers 2, which extend onto the gangways 8 so that the carrier pads 11 with the load 4 resting thereon can be slidingly displaced in longitudinal directions between posi-

tions outboard and inboard, and the carrier pads 11 can also be shiftable in a gliding or as said somewhat "floating" manner in transverse alignments 13 which are arranged under the support beams 10.

A carrier pad in the form of a flat jack pad, provided with a top layer of low friction, can also be constructed so large that a slide beam can freely move along it in longitudinal and transverse directions.

As carrier supports also so-called air or water skates can be used, which are not further represented.

The carrier pads 11 as illustrated in figure 11 are adapted to be fluid-pressurized by way of the hydraulic supply line indicated at 14, and are covered by a steel sheet 15, or a composite sandwich of steel and rubber, with thereon a glide lining of teflon 16 on which the support beams 10 will rest. Accordingly, the carrier pads 11 as represented in figure 11 are themselves not displaceable as in the here earlier described embodiment but occupy a fixed place while the load 4 may slide thereon for adjustment on the outriggers 2. To that end a slide shoe 17 of stainless steel can be placed under the load 4.

As a typical example, a slide pad 11 consisting of a fluid skate can have a carrying capacity per area dimension of 1 m^2 of more than 100 tons. A flat jack pad with teflon may carry a still many times higher load.

For shifting on or along the carrier or slide pads 11 the hydraulic jacks 18 as represented in figure 12 may be utilized, which are disposed between the ship structure and the supporting beams 10, and which are also adapted for compensation of the outrigger motion as a result of the water motion such as the swell.

Figures 13A and 13B depict in longitudinal view and in rear view the transfer of a heavy load 4 in the form of the illustrated topside of a drilling rig between the outriggers 2 and the jacket 5 of the drilling rig.

As shown, to that end cross-wires are passed from drums of winches 20 which are arranged aboard the ship 1, to their attachments on the legs 21 of the jack 5, said cross-wires 19 running on guide rollers 22 and comprising resilient means 23 for compensation of the water motion which is discernable aboard the ship 1.

When the correct adjustment is obtained, the legs 24 of the topside 4 of the drilling rig can be accurately threaded in the legs 24 of the jack 5 by means of a homing trunnion, and herewith the installation of the topside 4 of the drilling rig, which is transported by the ship 1, is then completed.

In figure 5 are furthermore shown carrier supports in the form of support legs 26 which are to be girded-on at the location of the outriggers 2 on each side of the ship 1, and are in the form of hollow columns which are to be trimmed by air pressure. The adjustment of the outriggers 2 under the load 4 can then be assisted by the regulation of valves, not shown, which are disposed in a control box 27, and regulate the air supply and discharge. To facilitate a proper girding-on of the support legs 26 onto the ship 1 a transverse beam connection 28 is provided therebetween at the location of the stern of the ship 1. Also at the location of the extended rear end of the outrigger tails 2 such a support or trim leg 26 can be provided, which is, however, not shown in figure 5 but which is to be connected with the two illustrated support legs 26 by a cross-structure of rungs.

Such carrier supports can also be provided for handling the jacket 5 of a drilling rig.

Figure 6 depicts a low gantry crane 7 by which submerged objects can be handled.

In view of figures 7-10 the lowering of a submerged system by means of a novel gripper system 33 will be described in the following:

An especially developed gripper system 33 will be applied for lowering below the sea level.

This gripper system 33 comprises a movable upper gripper 34 under the main hooks 35 of the ship 1 and a fixed lower gripper 36 which is arranged on an upper landing platform 37 and depends under the trolleys 38 of the ship' crane 7.

On the tackles 39 depends a lower landing platfrom 40 from which as shown the jacket 5 of a drilling rig is depending.

The gripper system 33 is designed on a safety factor of the work load of 2.5.

No substantial twisting of the manifold 2 is possible when using this system (vide figure 7). Moreover, the hanger wires 39, as shown in figure 8, may be tensioned by transverse or cross-wise extended coupling wires 41 to obviate any substantial torsion risk.

Figures 9 and 10 show the principle of the roll and pitch compensation. At 42 the swell compensation cylinder and at 43 the lifting cylinder is indicated and at 44 the pilot line. The clamps for alternately clamping and releasing the tackle wires 39 are indicated at 45.

A more detailed description of the lifting method follows herebelow in view of figures 14 and 15.

1. Brackets 46 are welded or clamped to the legs 47 of the jacket 5 at a suitable level (vide figure 14).

   The load is introduced via the diaphragm plates 48 and thus the brackets 46 are only subjected at a very low rate to bending and mainly shear.

2. Supports 49 are welded over the cutting splice 50.

The legs 47 are cut at the cutting level 50 before the actual lifting (vide figure 15A).
3. Support beams 51 are brought into position by means of the outriggers 2 of the ship 1 and connected to the drilling platform by rack clamps or slings 52 (vide figure 15B).
4. The ship 1 is finally positioned by means of dynamic positioning and/or cross mooring wires to the jacket 5.
5. When it is in position, the ship 1 is ballasted and 80% of the weigth of the topsides 4 is taken by ballasting.
6. Tracks with teflon are provided to compensate the horizontal motions of the ship 1.
7. Then the ship cranes 7 are moved forward on their wheels and the topsides 4 are lifted free from the jacket 5 in approximate half a minute in order to prevent hammering between the jacket 5 and the topsides 4.
8. The support beams are shimmed on the tracks so that further movement is no longer possible.
9. The ship 1 sails with the topsides 4 to a sheltered area where the topsides 4 are transferred to a barge or a quay.

Claims

1. A method of transporting, installing and removing a marine object such as a topside of a jacket platform by means of a buoyant body having longitudinal sides and transverse sides, the buoyant body comprising support structures projecting from one transverse side of the buoyant body at the upper portion thereof to support the object, wherein in the event of removal of said marine object said buoyant body is ballasted and moved towards said object, so as to receive said object on said support structures, after which said buoyant body is de-ballasted and the object is supported by the support structures, **characterized in that** said buoyant body comprises longitudinal side structures and a transverse structure connecting said longitudinal side structures and extending lengthwise and uninterruptedly from the other, opposite transverse side of the buoyant body to said one transverse side, said longitudinal side structures projecting upwardly from said transverse structure so as to form a generally U-shaped structure in cross-section, in that said support structures are formed as buoyancy-possessing outriggers which are integral with said buoyant body and substantially in alignment with the longitudinal side structures and project freely therefrom, in that in the event of removal of the object said outriggers are lowered to get into the water and moved to a position under said object to be removed and then raised again up to a level at which they support said object, and in that in the event of installation of the object said outriggers supporting said object are lowered to get into the water down to a level at which said object is supported by a fixed substructure, after which they are horizontally transferred to a position remote from said object.

2. Method as claimed in claim 1, **characterized in that** horizontal motions of the buoyant body during installation or removal are compensated by a low-friction system between the outriggers and the object.

3. Method as claimed in claim 1 or 2, **characterized in that** said object is supported by said outriggers during transport.

4. Method as claimed in claim 1, 2 or 3, **characterized in that** said transverse structure is lowered below water level when said buoyant body is ballasted during said installing or removing operations.

5. Vessel comprising a buoyant body having marine object support structures projecting from one transverse side of the upper portion of said buoyant body as well means for ballasting or de-ballasting said buoyant body, **characterized in that** said buoyant body comprises longitudinal side structures and a transverse structure connecting said longitudinal side structures and extending lengthwise and uninterruptedly from the other, opposite transverse side of the buoyant body to said one transverse side, in that said support structures are formed as buyoncy-possessing outriggers which are integral with said buyont body and substantially in alignment with the longitudinal side structures and project freely therefrom, and in that said longitudinal side structures project upwardly from said transverse structure so as to form a generally U-shaped structure in cross-section.

6. Vessel as claimed in claim 5, **characterized in that** said outriggers have support surfaces which are arranged flush with upper surfaces of the remaining part of said longitudinal side structures.

7. A device according to any of claims 5 or 6, **characterized by** a support beam structure (10) for arranging the load (4) directly on the outriggers (2).

8. A device according to any of the claims 5-7, **characterized by** carrier pads (11) having a low-friction top layer, said carrier pads being pressurized, wherein the pressure is fluid controlled to enable compensation for horizontal and vertical motions of the outriggers.

9. A device according to claim 8, **characterized in that** the carrier pads (11) are adjustable in longitudinal alignments (12) on the outriggers (2) and in that the longitudinal alignments extend onto the gangways (8) of the vessel (1) so that the carrier pads with the load (4) carried thereby are displaceable between outboard and inboard positions.

10. A device according to claim 7, 8 or 9, **characterized in that** the support beams (10) are actively controlled by hydraulic cylinders (14) which control the support beams in view of the motions of the outriggers (2).

Patentansprüche

1. Verfahren zum Transport, zur Aufstellung oder Entfernung einer Meersesanlage wie ein Oberbau einer "Jacket"-Plattform durch einen schwimmenden Körper mit Längs- und Querseiten, wobei der schwimmende Körper Tragekonstruktionen, die von einer Querseite des schwimmenden Körpers an dem oberen Teil davon herausragen um die Anlage zu tragen, umfasst, wobei im Falle der Entfernung der Meeresanlage der schwimmende Körper mit Ballast beladen wird und in die Richtung der Anlage gefahren wird um die Anlage auf die Tragekonstruktionen zu empfangen, wonach der Ballast von dem schwimmenden Körper entladen wird und die Anlage durch die Tragekonstruktionen getragen wird, **dadurch gekennzeichnet, daß** der schwimmende Körper Längsseitenkonstruktionen und eine Querkonstruktion umfasst, die die Längsseitenkonstruktionen verbindet und die sich der Länge nach und ununterbrochen von der anderen, gegenüberliegenden Querseite des schwimmenden Körpers bis zur genannten einen Querseite ausstreckt, wobei die Längsseitenkonstruktionen sich ab der Querkonstruktion emporragen, um im Querschnitt eine im wesentlichen U-förmige Konstruktion zu bilden, daß die Tragekonstruktionen als mit Schwimmkraft versehenen Ausleger gebildet sind, die mit dem schwimmenden Körper integral sind und im wesentlichen mit den Längsseitenkonstruktionen ausgerichtet sind und frei davon ausragen, daß im Falle der Entfernung der Anlage die Ausleger heruntergelassen werden um ins Wasser zu gelangen und in eine Position unter der zu entfernenden Anlage gefahren werden und wieder hochgehoben werden bis zu einem Niveau, worauf sie die Anlage tragen, und dadurch, daß im Falle der Aufstellung die Ausleger, die die Anlage tragen, herunter gelassen werden um ins Wasser zu gelangen bis zu einem Niveau worauf die Anlage durch ein festes Unterbau getragen wird, wonach sie horizontal nach einer von der Anlage entfernten Position verlegt werden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, daß** horizontale Bewegungen des schwimmenden Körpers während der Aufstellung oder Entfernung durch ein mit geringer Reibung arbeitendes System zwischen Auslegern und der Anlage ausgeglichen werden.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** die Anlage während des Transports durch die Ausleger getragen wird.

4. Verfahren nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, daß** die Querkonstruktion unterhalb des Wasserspiegels heruntergelassen wird, wenn der schwimmende Körper während Aufstellungs- oder Entfernungsarbeiten mit Ballast beladen wird.

5. Schiff umfassend einen schwimmenden Körper, mit Tragekonstruktionen für Meeresanlagen, die von einer Querseite des oberen Teils des schwimmenden Körpers hervorragen, ebenso Mittel zum mit Ballast beladen oder Entladen des schwimmenden Körpers, **dadurch gekennzeichnet, daß** der schwimmende Körper Längsseitenkonstruktionen und eine Querkonstruktion, die die Längsseitenkonstruktionen verbindet und die sich der Länge nach und ununterbrochen von der anderen, gegenüberliegenden Querseite des schwimmenden Körpers bis zur genannten einen Querseite ausstreckt, umfasst, wobei die Tragekonstruktionen als mit Schwimmkraft versehenen Ausleger gebildet sind, die mit dem schwimmenden Körper integral sind und im wesentlichen mit den Längsseitenkonstruktionen ausgerichtet sind und frei davon ausragen, und daß die Längsseitenkonstruktionen von der Querkonstruktion emporragen um eine im wesentlichen im Querschnitt U-förmige Konstruktion zu bilden.

6. Schiff nach Anspruch 5, **dadurch gekennzeichnet, daß** die Ausleger Tragflächen haben, die mit den oberen Flächen des übrigge-

bliebenen Teil der Längsseitenkonstruktionen fluchten.

7. Eine Vorrichtung nach einem der Ansprüche 5 oder 6, **gekennzeichnet durch** eine Tragbalkenkonstruktion (10) zum Anordnen der Ladung (4) unmittelbar auf die Ausleger (2).

8. Eine Vorrichtung nach einem der Ansprüche 5-7, **gekennzeichnet durch** Tragkissen (11) die eine Oberschicht mit niedriger Reibung haben und unter Druck gesetzt werden, wobei der Druck mittels Flüßigkeit kontrolliert wird, um horizontale und vertikale Bewegung der Ausleger kompensieren zu können.

9. Eine Vorrichtung nach Anspruch 8, **gekennzeichnet dadurch, daß** die Tragkissen (11), die in Längsausrichtungen (12) auf den Auslegern (2) einstellbar sind und dadurch, daß sich die Längsausrichtungen bis zu den Landungsbrücken (8) des Schiffes (1) ausstrecken, so daß die Tragkissen mit der durch diese getragenen Ladung (4) zwischen Außenbord- und Innenbordpositionen verlagerbar sind.

10. Eine Vorrichtung nach Anspruch 7, 8 oder 9, **dadurch gekennzeichnet, daß** die Tragbalken (10) durch hydraulische Zylinder (14) auf aktive Weise controlliert werden, welche Zylinder die Tragbalken hinsichtlich der Bewegungen der Ausleger (2) kontrollieren.

Revendications

1. Procédé de transport, d'installation et d'enlèvement d'un objet marin, tel que les hauts d'une plate-forme à enveloppe, à l'aide d'un corps flottant ayant des côtés longitudinaux et des côtés transversaux, le corps flottant ayant des structures de support dépassant d'un côté transversal du corps flottant à la partie supérieure de celui-ci pour le support de l'objet, dans lequel, en cas d'enlèvement de l'objet marin, le corps flottant est ballasté et déplacé vers l'objet afin qu'il reçoive l'objet sur les structures de support, et le corps flottant est ensuite déballasté et l'objet est supporté par les structures de support, caractérisé en ce que le corps flottant comporte des structures des côtés longitudinaux et une structure transversale raccordant les structures des côtés longitudinaux et disposée longitudinalement et de manière ininterrompue depuis l'autre côté transversal opposé du corps flottant vers le premier côté transversal, les structures des côtés longitudinaux dépassant au-dessus de la structure transversale pour la formation d'une structure ayant en coupe une forme générale en U, en ce que les structures de support sont formées par des arcs-boutants possédant de la flottabilité et qui sont solidaires du corps flottant et pratiquement alignés sur les structures des côtés longitudinaux et qui dépassent librement de celles-ci, en ce que, en cas d'enlèvement de l'objet, les arcs-boutants sont descendus afin qu'ils pénètrent dans l'eau et se déplacent en position sous l'objet à enlever et soient soulevée à nouveau au niveau auquel ils supportent l'objet, et en ce que, en cas de l'installation de l'objet, les arcs-boutants supportant l'objet sont descendus afin qu'ils pénètrent dans l'eau jusqu'au niveau auquel l'objet est supporté par une infrastructure fixe, et ils sont ensuite transférés horizontalement vers une position distante de l'objet.

2. Procédé selon la revendication 1, caractérisé en ce que les déplacements horizontaux du corps flottant pendant l'installation ou l'enlèvement sont compensés par un ensemble à faible coefficient de frottement placé entre les arcs-boutants et l'objet.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que l'objet est supporté par les arcs-boutants pendant le transport.

4. Procédé selon la revendication 1, 2 ou 3, caractérisé on ce que la structure transversale est descendue au-dessous du niveau de l'eau lorsque le corps flottant est ballasté pendant les opérations d'installation ou d'enlèvement.

5. Navire comprenant un corps flottant ayant des structures de support d'un objet marin qui dépassent d'un côté transversal de la partie supérieure du corps flottant ainsi qu'un dispositif de ballastage ou de déballastage du corps flottant, caractérisé en ce que le corps flottant comprend des structures des côtés longitudinaux et une structure transversale raccordant les structures des côtés longitudinaux et disposée suivant la longueur et de façon ininterrompue depuis l'autre côté transversal opposé du corps flottant vers le premier côté transversal, en ce que les structures de support sont formées par des arcs-boutants possédant une flottabilité et qui sont solidaires du corps flottant et pratiquement alignés sur les structures des côtés longitudinaux et qui dépassent librement de celles-ci, et en ce que les structures des côtés longitudinaux dépassent au-dessus de la structure transversale pour former une structure ayant en coupe une forme générale en U.

6. Navire selon le revendication 5, caractérisé en ce que les arcs-boutants ont des surfaces de support qui sont disposées au niveau des surfaces supérieures de la partie restante des structures des côtés longitudinaux.

7. Appareil selon l'une des revendications 5 et 6, caractérisé par une structure (10) à poutres de support destinée à placer la charge (4) directement sur les arcs-boutants (2).

8. Appareil selon l'une des revendications 5 à 7, caractérisé par des patins (11) de support ayant une couche supérieure à faible coefficient de frottement, les patins de support étant mis sous pression, la pression étant réglée par un fluide afin qu'elle permette la compensation des déplacements horizontaux et verticaux des arcs-boutants.

9. Appareil selon la revendication 8, caractérisé en ce que les patins de support (11) sont ajustables dans l'alignement longitudinal (12) des arcs-boutants (2), et en ce que l'alignement longitudinal passe sur les passavants (8) du navire (1) afin que les patins de support qui supportent la charge (4) puissent être déplacés entre les positions à l'extérieur et à l'intérieur.

10. Appareil selon la revendication 7, 8 ou 9, caractérisé en ce que les poutres de support (10) sont commandées de manière active par des vérins hydrauliques (14) qui commandent les poutres de support en fonction des déplacements des arcs-boutants (2).

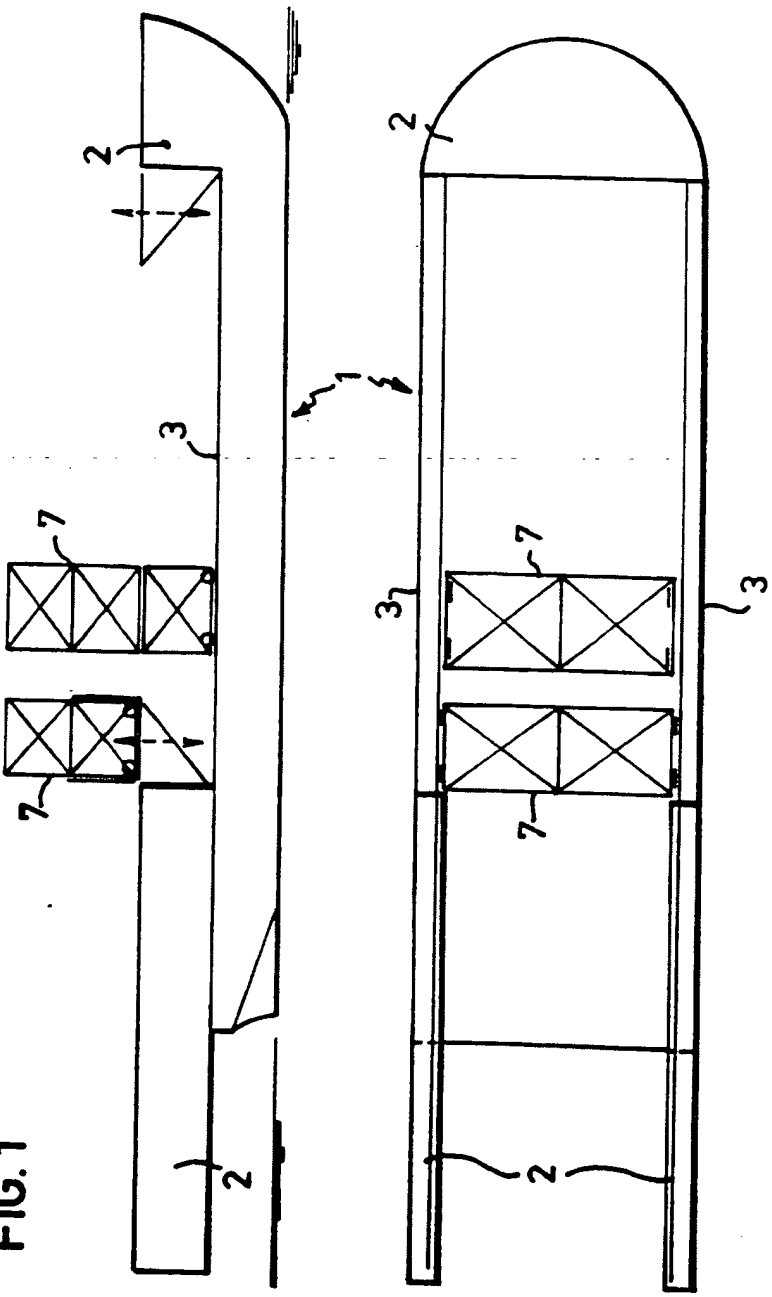


FIG. 1

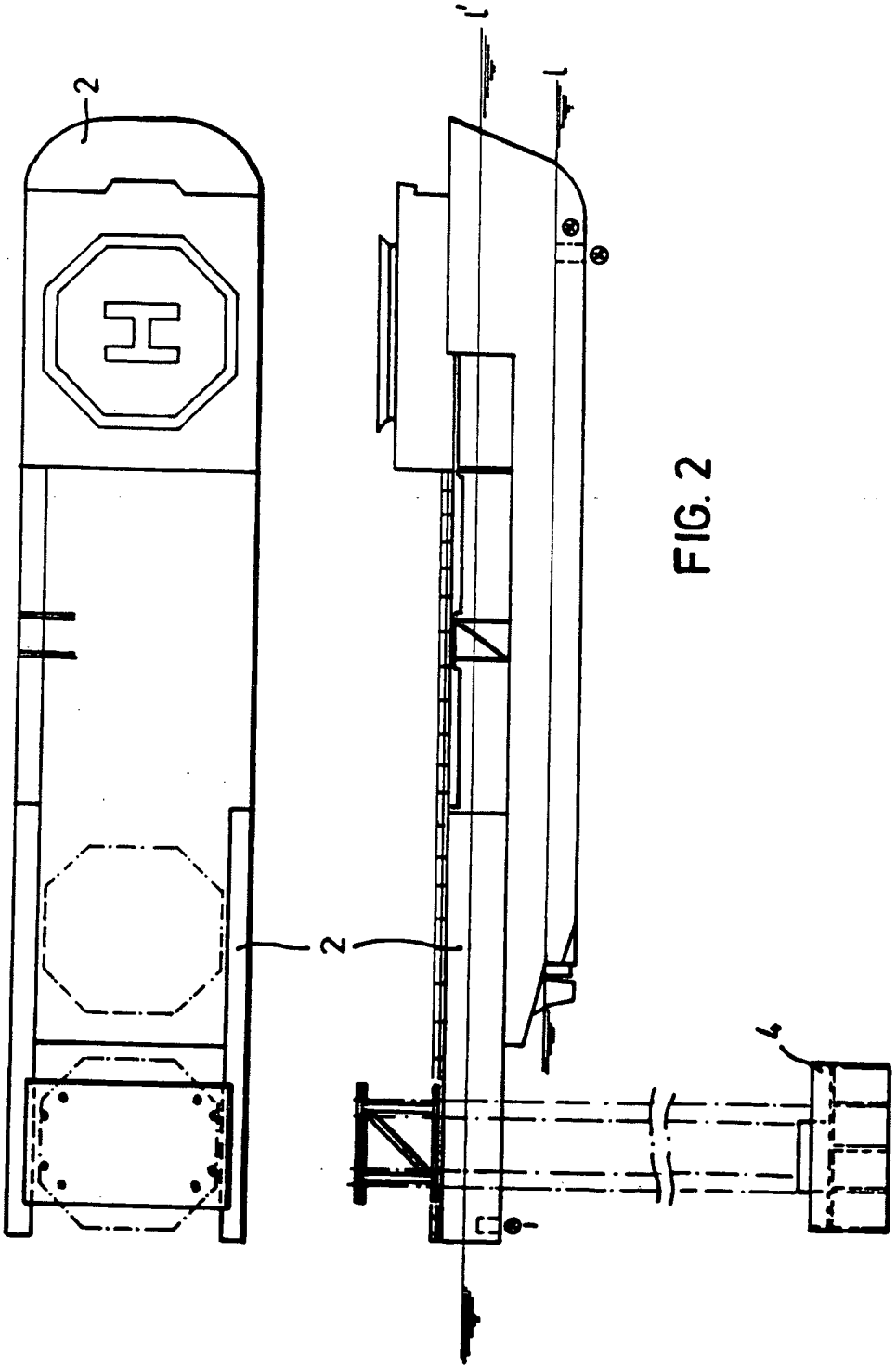


FIG. 2

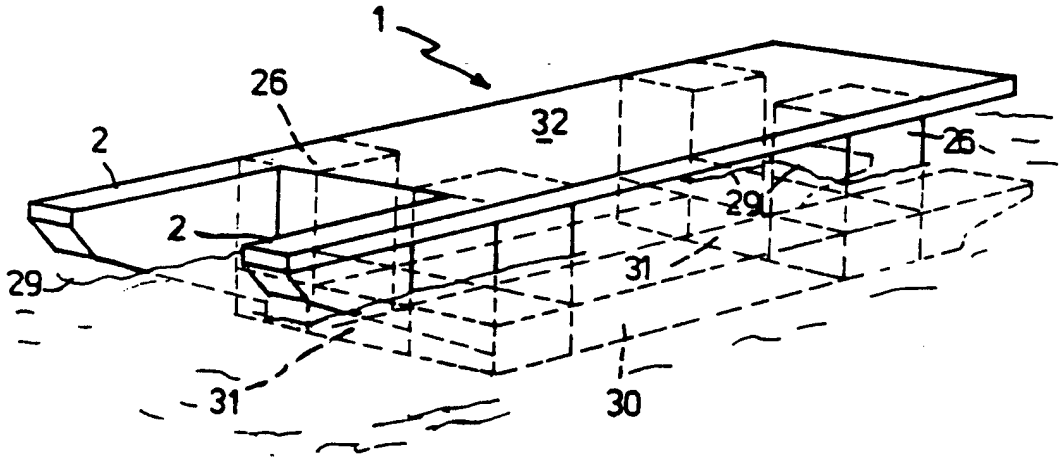


FIG. 3

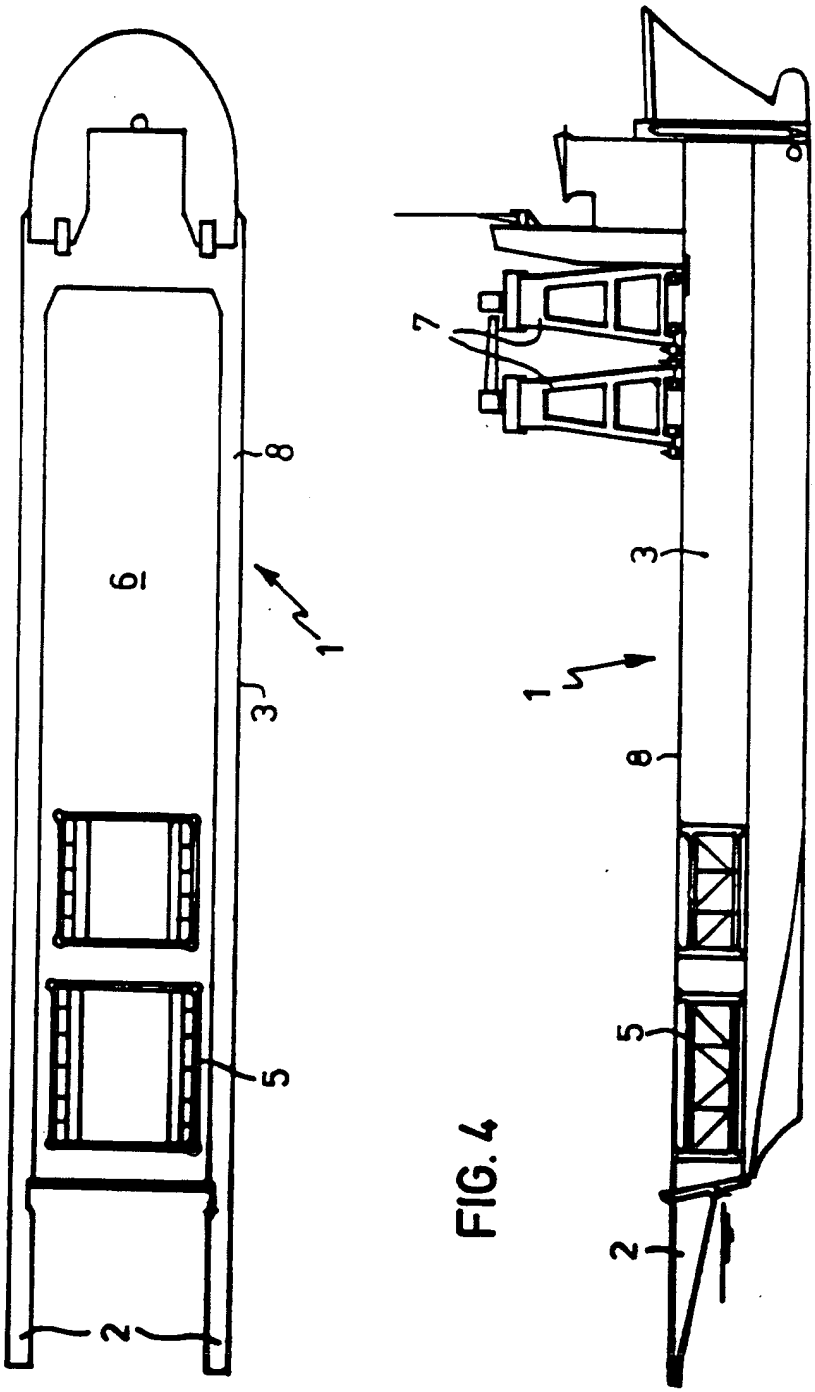


FIG. 4

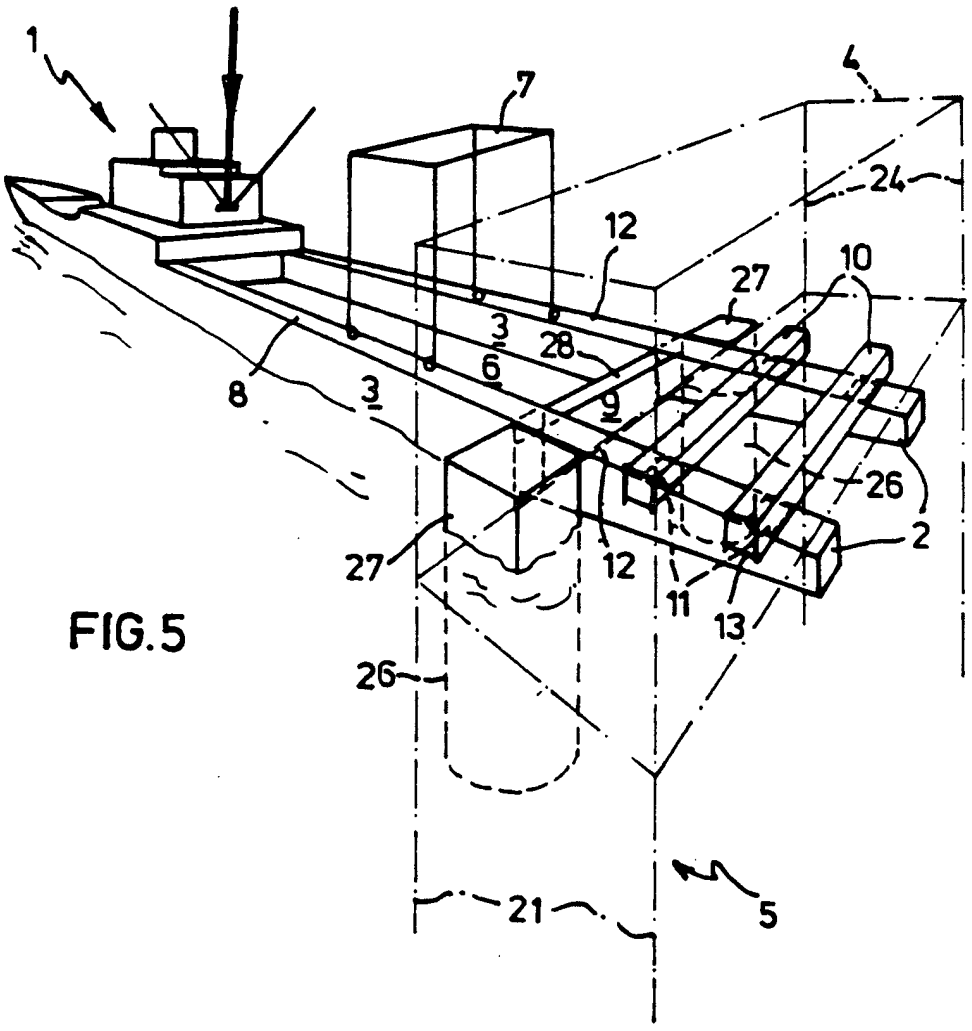
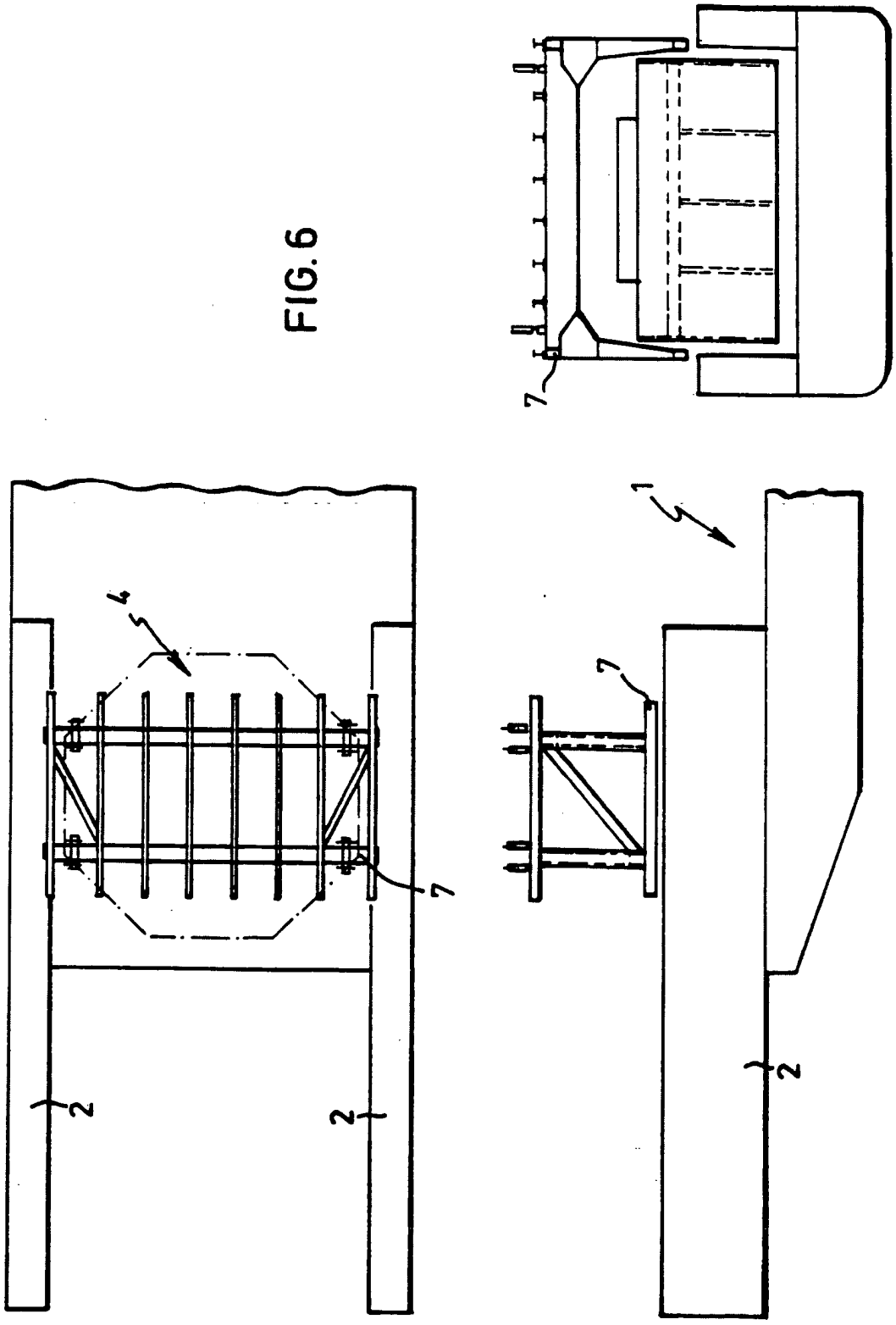


FIG.5

FIG.6



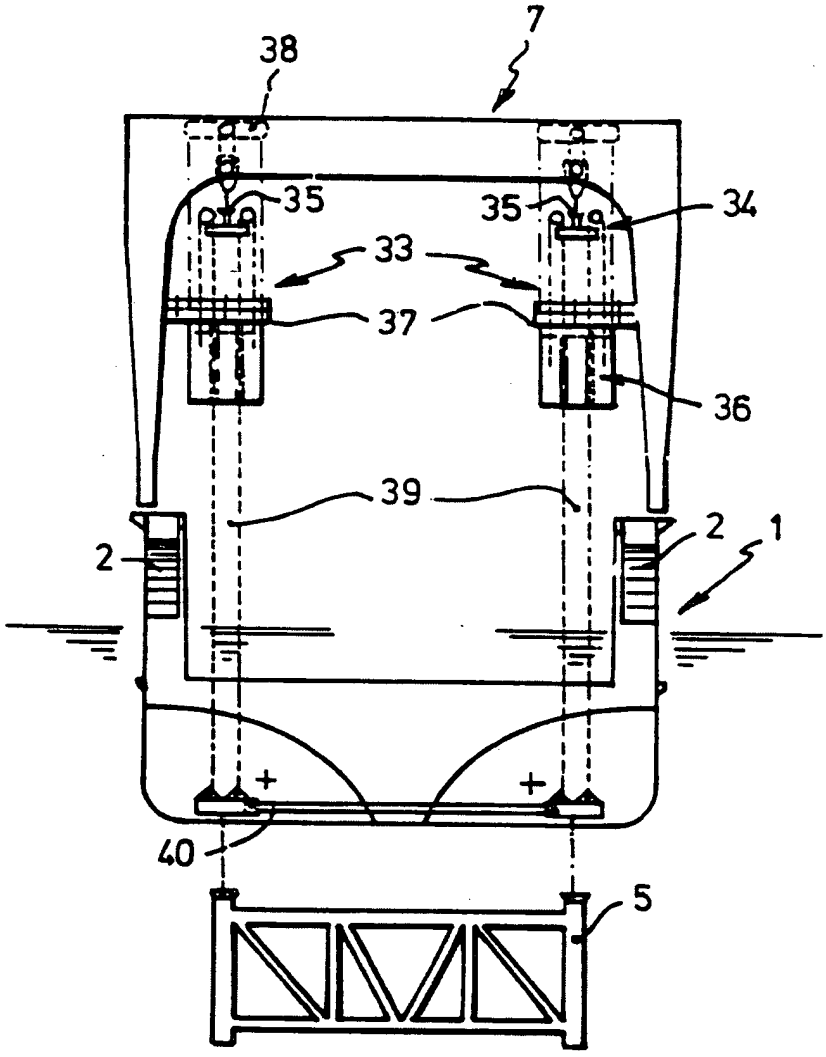


FIG.7

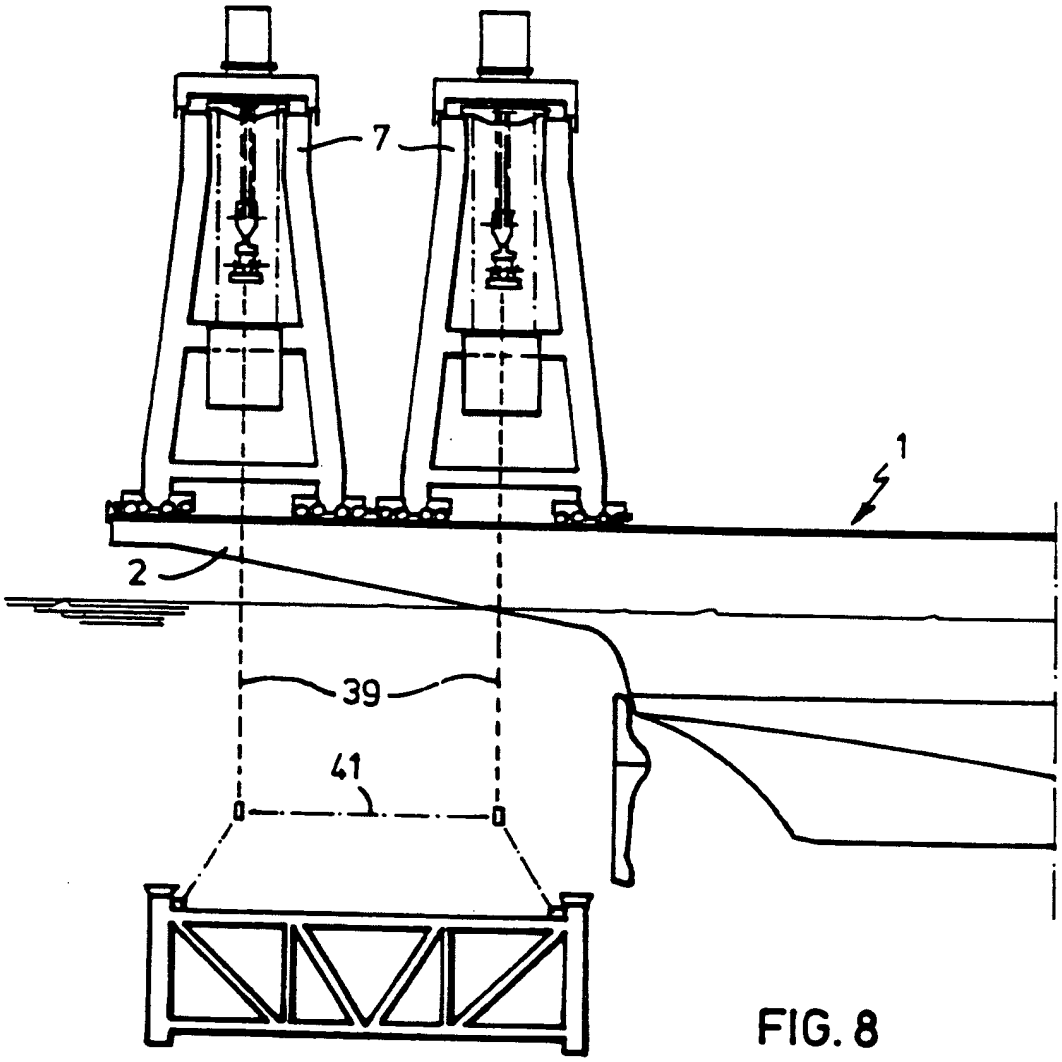


FIG. 8

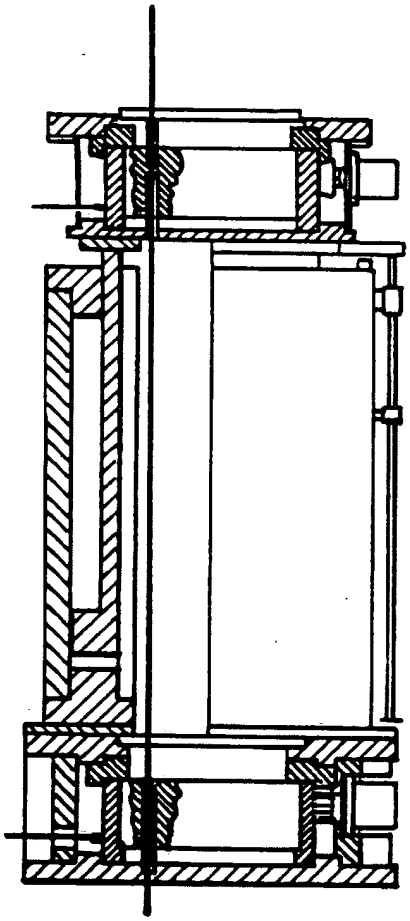
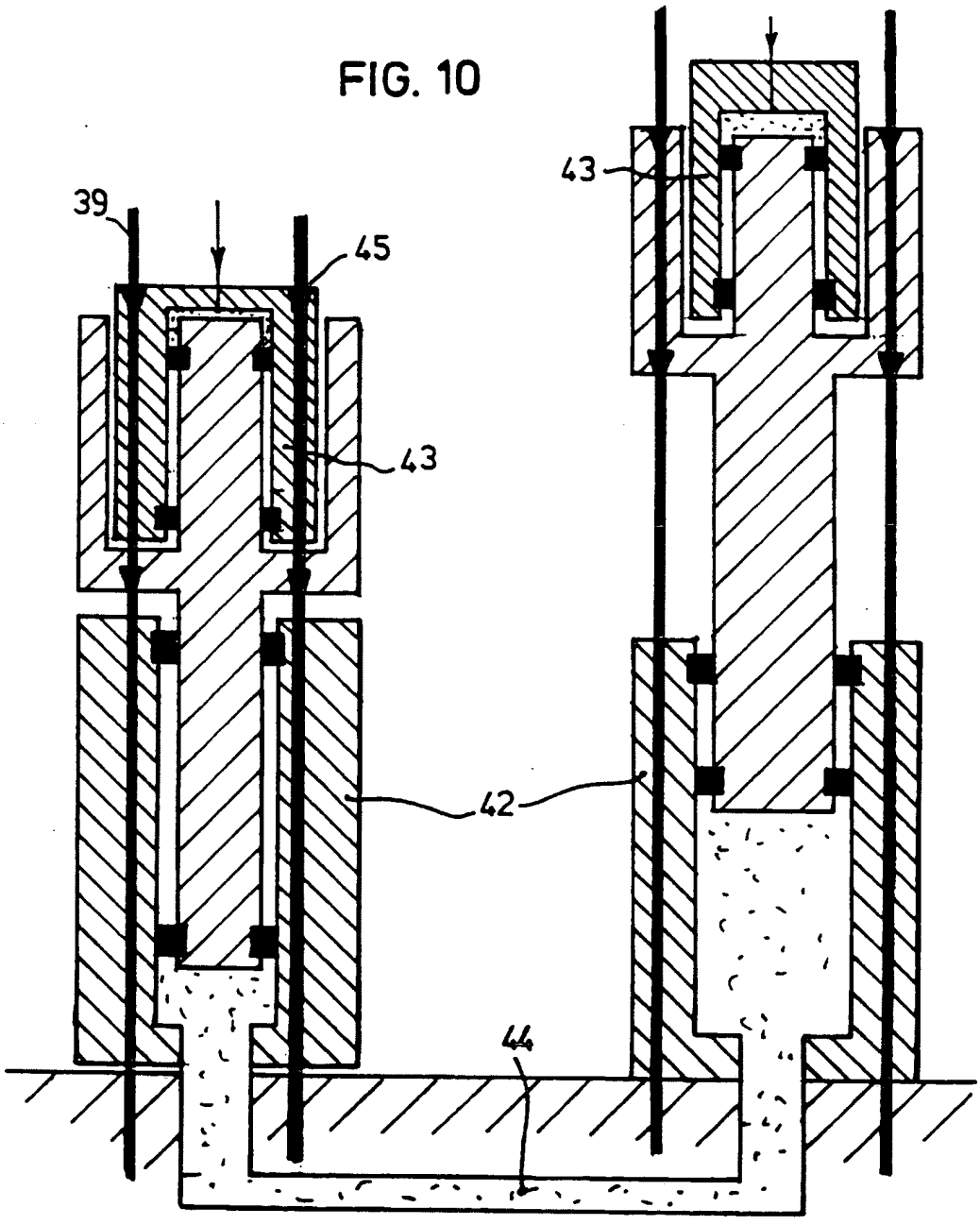


FIG. 9

FIG. 10



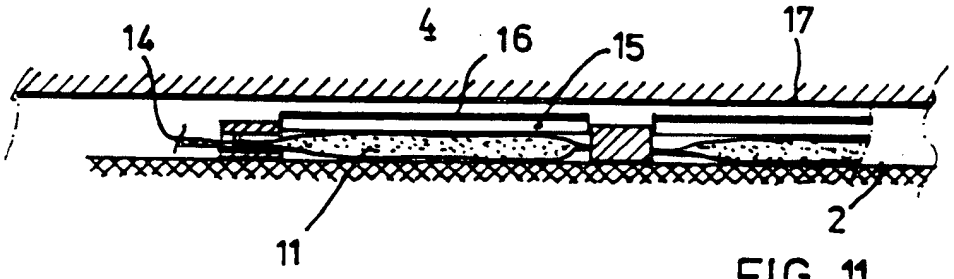


FIG. 11

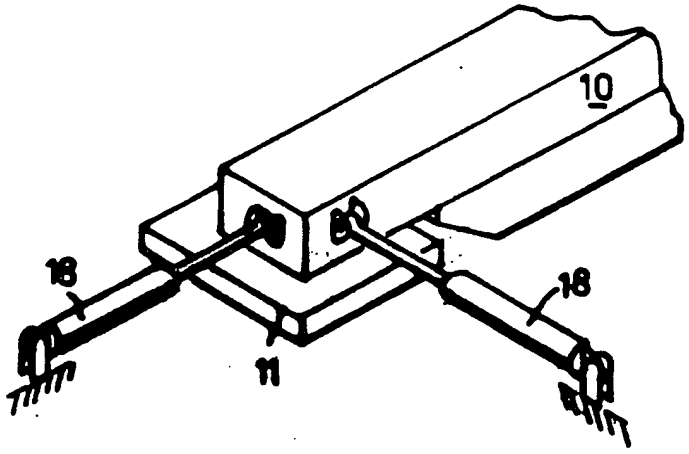


FIG. 12

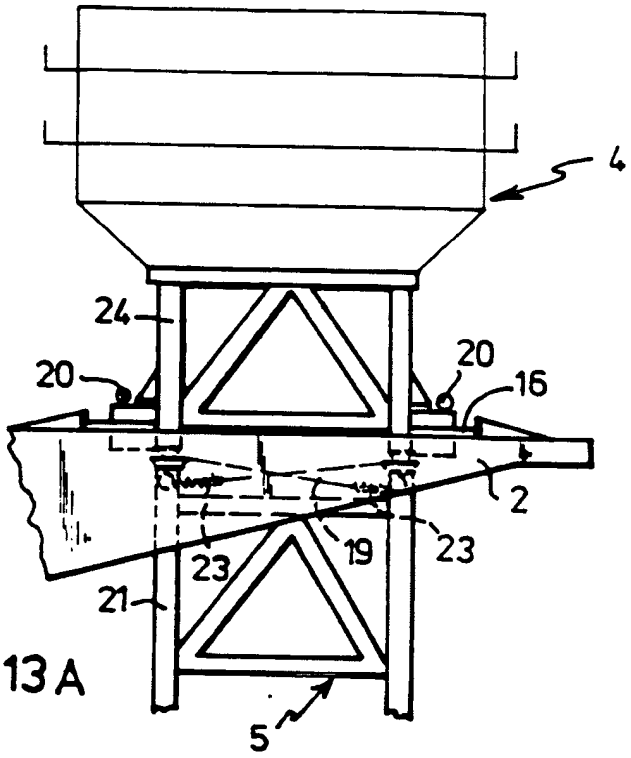


FIG. 13A

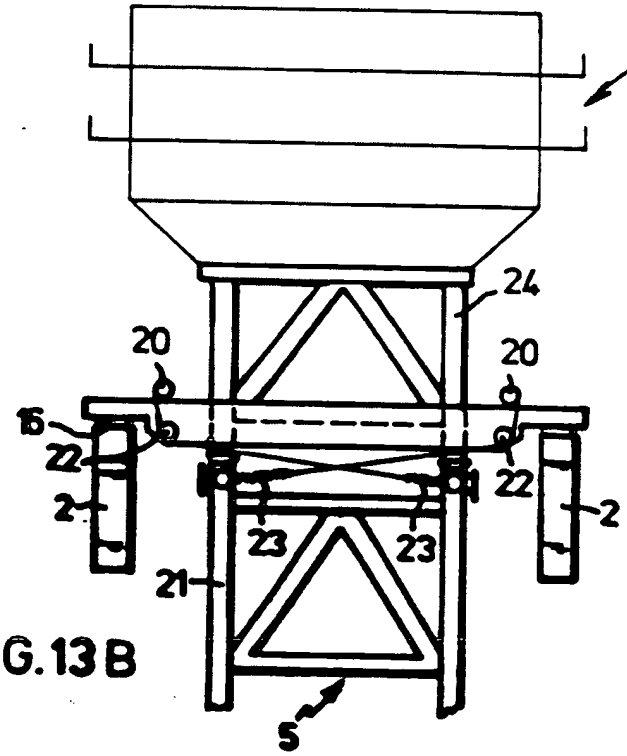


FIG. 13B

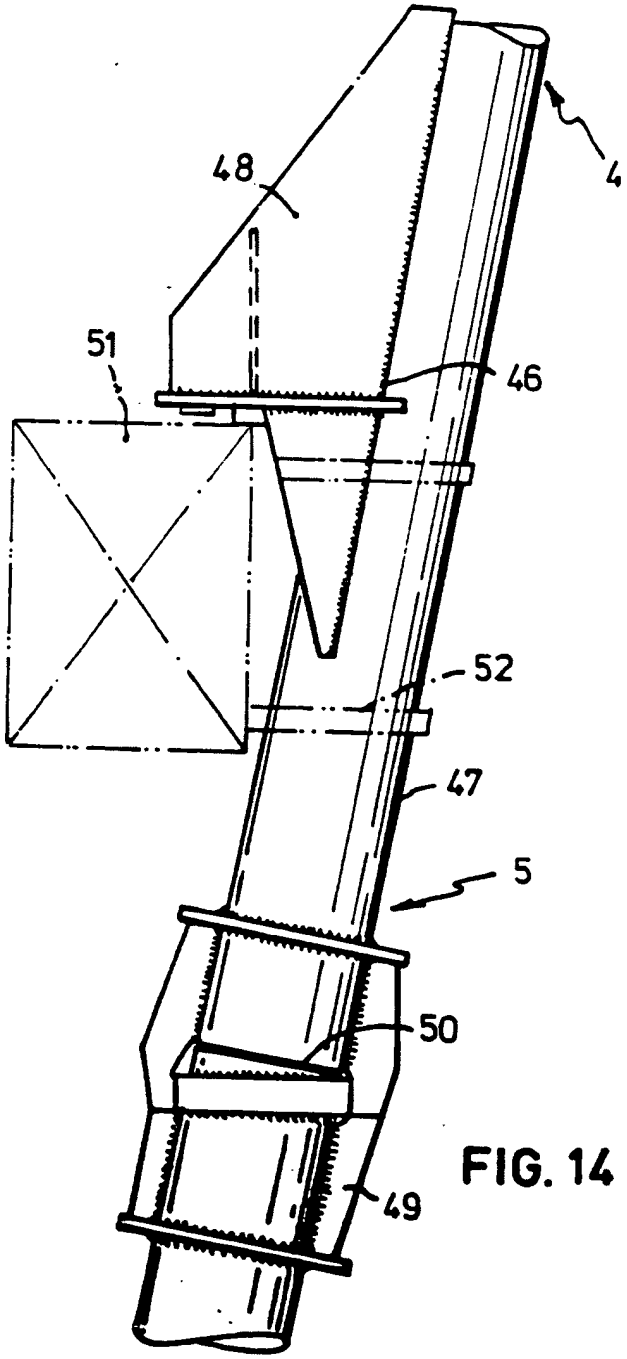


FIG. 14

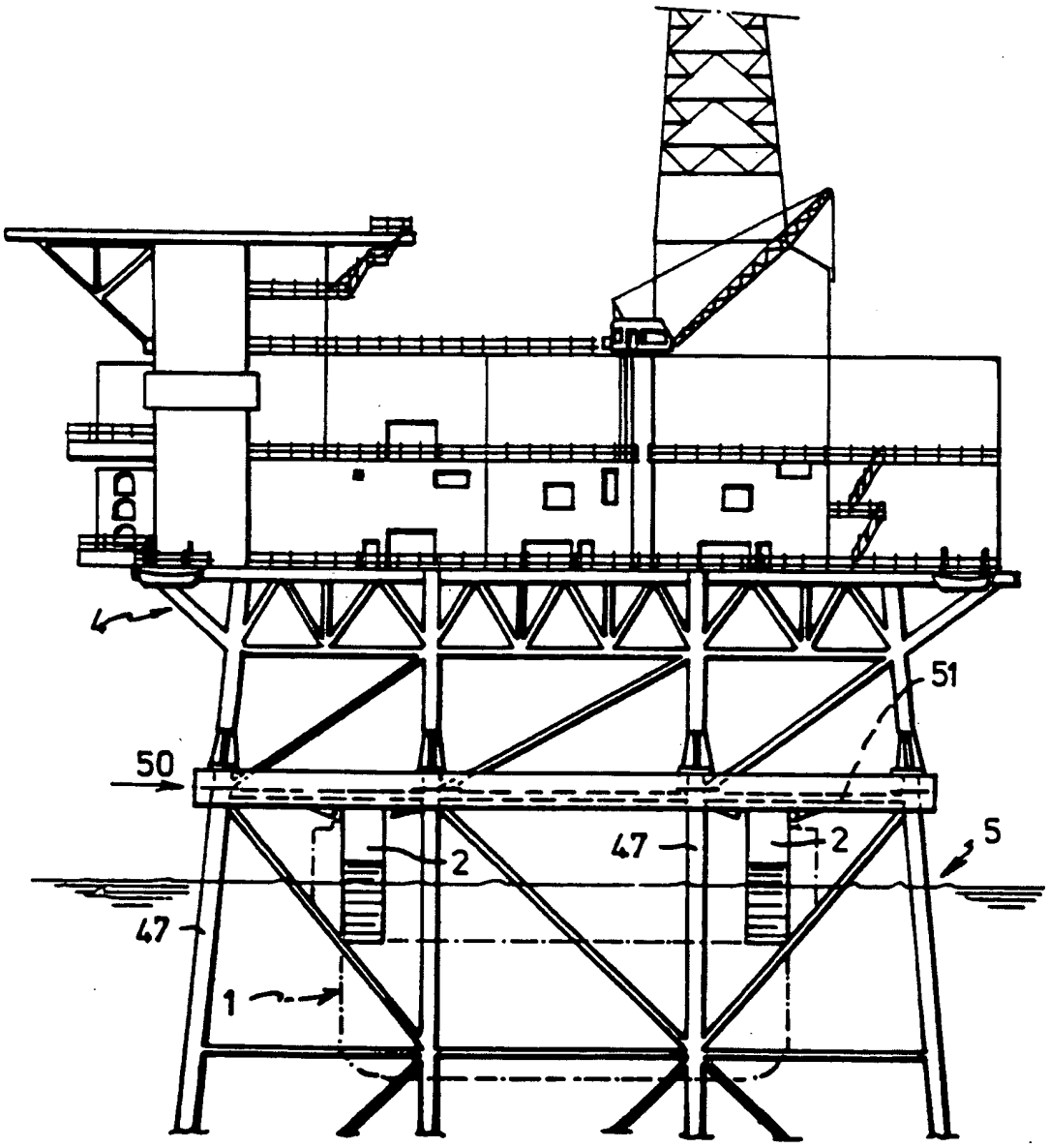


FIG.15A

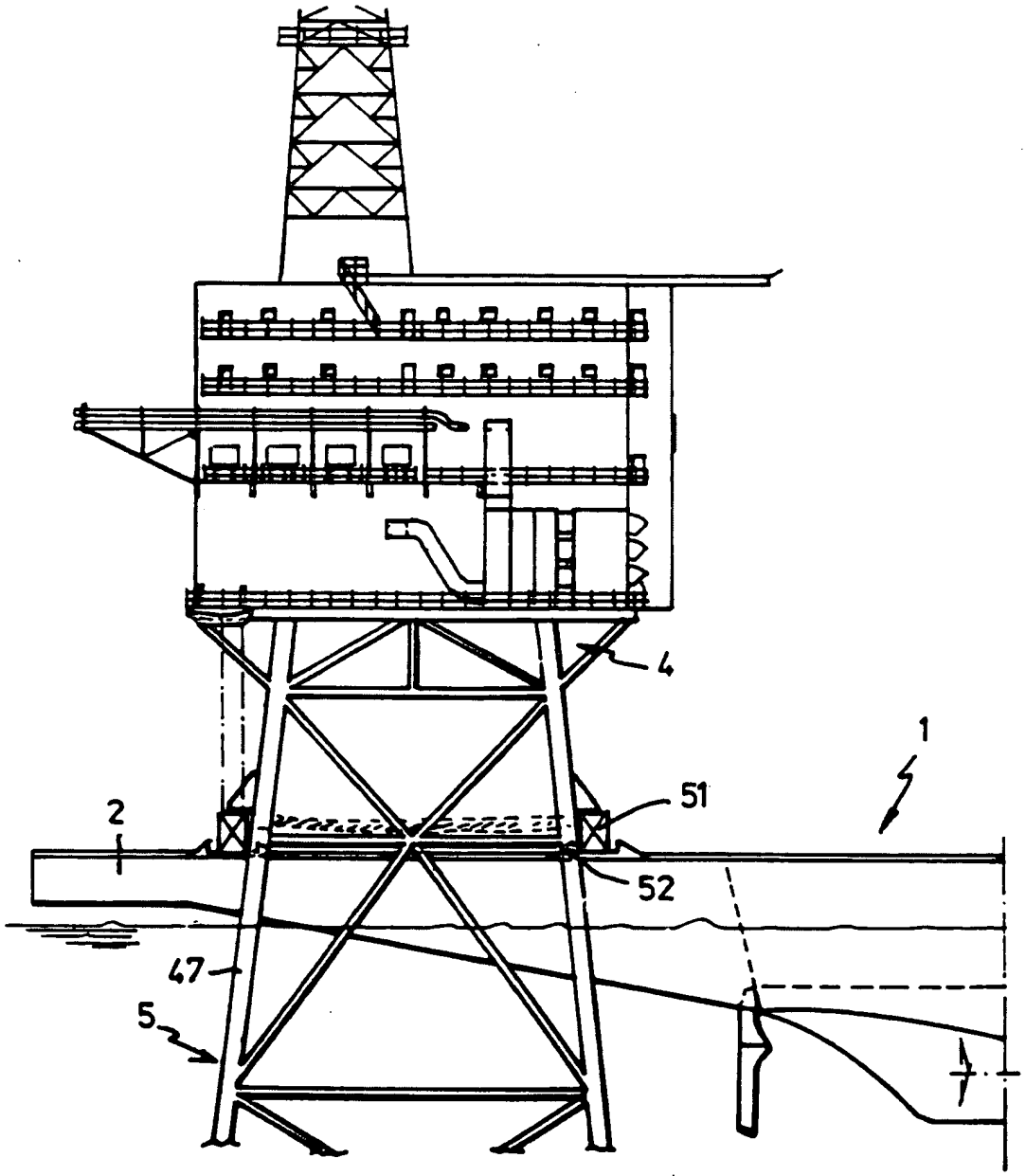


FIG. 15 B